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FOREST INSECT and DISEASE CONDITIONS in the Intermountain States during 1970

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BRANCH OF FOREST INSECT AND DISEASE PREVENTION AND CONTROL
DIVISION OF TIMBER MANAGEMENT
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U.S. DEPARTMENT OF AGRICULTURE
OGDEN, UTAH

COVER STORY

Estimates of losses in lodgepole pine forests due to the mountain pine beetle, *Dendroctonus ponderosae* Hopkins, are conflicting and unreliable. It is important to obtain accurate estimates, not only from a resource management standpoint, but because they also provide heretofore unknown information on some aspects of infestation trends.

One method of obtaining impact and trend data is through the use of the "variable plot" method of cruising. This method lowers sampling costs while providing more detailed and accurate stand data.

The "Spiegel-relaskop" is an instrument used to measure critical angles, which also automatically corrects for slopes.

FOREST INSECT & DISEASE CONDITIONS IN THE INTERMOUNTAIN STATES DURING 1970

Compiled By

Douglas L. Parker

Douglas L. Parker – Entomology

Alfred C. Tegethoff – Pathology

May 1971

Branch of Forest Insect and Disease Prevention and Control
Division of Timber Management
Region Four Forest Service
U.S. Department of Agriculture
Ogden, Utah

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ENTOMOLOGY

Two species of *Dendroctonus* bark beetles were the major forest insects damaging the timber resources in the Intermountain Region. The mountain pine beetle was the most important of the two, particularly in the lodgepole pine forests of southeast Idaho. The most extensive infestation was on the Targhee National Forest and in adjoining Yellowstone National Park. A large infestation in Grand Teton National Park reached a peak in 1970. The beetle population on the adjoining Teton National Forest was at the lowest level recorded since the massive infestations of the 1960's. Lodgepole pine mortality was at a high level on both Divisions of the Bridger National Forest. Depletion of stands continued on the Caribou National Forest.

In 1970, mountain pine beetle-caused mortality in other tree species continued at about the same level as observed in 1969. Ponderosa pine mortality continued on the Ashley National Forest in northeastern Utah and on the Dixie National Forest and adjoining Bryce Canyon National Park in southern Utah. Build-ups in limber pine were detected on high elevation sites on the Targhee and Ashley National Forests.

A second important *Dendroctonus* beetle was the Douglas-fir beetle. This beetle caused widespread damage to old-growth Douglas-fir on the Boise, Payette, Salmon, and Sawtooth National Forests. Activity of a lesser extent occurred on the Challis and Targhee National Forests. A study to test the attractiveness of a synthetic pheromone, frontalin, on this beetle was encouraging.

Two other *Dendroctonus* species caused problems in the Region. A new and extensive spruce beetle infestation was detected on the Manti-LaSal National Forest in central Utah. The spruce beetle infestation on the Fishlake National Forest near Hilgard Mountain continued. The round-headed pine beetle caused scattered mortality in the ponderosa pine type on the Toiyabe National Forest near Las Vegas, Nevada.

The most important defoliator in the Region, the western budworm, was at the lowest level observed in several years. The major infestations were on the Payette National Forest in southwestern Idaho and on the Bridger, Targhee, and Teton National Forests in southeastern Idaho and western Wyoming. A small infestation continued on the Ashley National Forest.

Other miscellaneous forest and range insects are discussed.

PATHOLOGY

More *Fomes annosus* infection centers were found in 1970.

F. applanatus, which causes a root and butt rot of aspen, depleted the aspen cover in a campground on the Cache National Forest, Utah.

A case of possible resistance of lodgepole pine to western gall rust, *Peridermium harknessii,* was noted on the Boise National Forest in Idaho.

Increased concern, measured in terms of the number of requests for assistance, developed over the effects of uncontrolled emissions from coal-fired electrical generating stations and smelters.

Participation in land use studies also increased.

ENTOMOLOGY

Bark Beetles

Mountain pine beetle, *Dendroctonus ponderosae* Hopkins

Lodgepole pine

The mountain pine beetle has caused extensive damage throughout the lodgepole pine stands of southeastern Idaho and western Wyoming during the past ten years. The most damaging infestations occurred on the Targhee, Teton, Bridger, and Caribou National Forests and in Grand Teton and Yellowstone National Parks. Beetle activity characteristically started in low elevation stands, intensified, and spread into stands at higher elevations. Unchecked infestations often reached a peak in three to five years and then started to decrease. In 1970, some infestations continued to increase, but overall beetle activity decreased.

Chemical control measures slowed tree attrition in some areas on the Teton and Targhee National Forests and in Grand Teton National Park, but the suppression

of beetle populations only prolonged the infestations and failed to reduce overall tree mortality. The main factor precluding further beetle damage in both control and non-control areas was the eventual depletion of suitable host trees.

The most severe infestation, as has been the case since 1967, was on the Targhee National Forest. Forest-wide, tree mortality decreased from the 1969 peak level but the overall loss was still high. The most intense portion of this infestation was at the north-eastern end of the Forest along the west and south boundaries of Yellowstone National Park and south along the west slope of the Teton Mountain Range. The predominance of contiguous stands of mature and overmature lodgepole pine supported the damaging outbreak in this area. A further decrease in activity should continue next year.

Suppression measures have been undertaken since 1968 in the Warm River area of the Targhee National Forest with the objective of protecting merchantable stands of threatened timber. Treating records show that the infestation level was reduced from 1968 to 1969 but a resurgence occurred from 1969 to 1970. Invasion of beetles from high intensity infestations to the east in Yellowstone National Park and to the south on the Forest, along with the existing population, caused this increasing trend. However, the level of the infestation in the control area was lower than in uncontrolled areas, and attrition of stands was not as excessive.

Depletion of stands in the Warm River area should increase in 1971, because the control project will be discontinued. An analysis revealed that the cost-benefit ratio for continuation of chemical treatment was unfavorable.

To the immediate east of the control area in Yellowstone National Park, the infestation continued to increase in extent and intensity. In the extreme southwest corner, tree killing decreased from 27.5 trees per acre in 1969 to 3 trees per acre in 1970. Elsewhere, a static to increasing situation existed. There are indications that the infestation has spread into some of the heavily used recreational areas of the Park and an intensification could occur. Studies of beetle activity at high elevations, similar to that found in the Park, indicate that depletion of stands is less than that found in lower zones. Whether or not this reduction in mortality will occur remains to be seen.

Scattered tree killing continued on the Ashton and Island Park Districts in the north. These infestation centers have remained static or have decreased during the past year and should continue to do so for the next two to three years.

On the Rexburg and Swan Valley Districts, tree killing continued to decrease in 1970. The once huge outbreak on the Rexburg District, which seriously depleted the merchantable lodgepole pine stands and virtually eliminated timber harvesting opportunities, has almost subsided.

An aerial view of a mountain pine beetle infestation in lodgepole pine (Yellowstone National Park, 1970). The lower two-thirds of the photograph shows a portion of an area surveyed in 1969; 27.5 current attacks per acre were recorded.

On the eastern side of the Teton Range in Grand Teton National Park, tree mortality remained at a high level in 1970. Since 1967, when control was terminated, a resurgence in beetle activity developed. Lodgepole pine stands around Jackson Lake to Phelps Lake have suffered serious losses for the past two years. Some infestation centers, such as those along the east boundary, have reached a peak and are declining; others remain static. Biological evaluations indicate that a general decrease in tree mortality will occur in 1971. Once again, the limiting factor is the lack of suitable host trees.

On the neighboring Teton National Forest, tree killing remained at a low level. Scattered mortality occurred in the upper reaches of some drainages in and around Antelope Point. Widely scattered tree mortality also continued in the Hoback River drainage. The infestation on the Teton National Forest should continue to decrease in 1971.

In contrast to the decreasing trend on the Teton National Forest, infestations on the adjoining Bridger National Forest are on the increase. On the Wyoming Division, barring any unforseen natural controlling factors, tree killing will continue to increase and probably reach a peak in 1971. Increases will occur in the upper portions of the Little Greys and Greys River. Static to decreasing trends will occur at other locations in the Greys River drainage. The long-lasting infestations in Middle Beaver Creek and in Chall Creek will continue at a low level.

The loss of merchantable timber on the Wyoming Division has been heavy, but well-planned salvage operations have utilized a considerable volume that otherwise would have been lost. When infestations are well established, as on this Division, the only practical approach is to accelerate logging in and ahead of infestations to utilize threatened timber. Chemical control is not a practical alternative.

An intense infestation extends throughout the entire range of lodgepole pine on the Bridger Division. Infested trees were observed from Dollar Lake south along the west slope of the Wind River Range to the East Sweetwater River. This epidemic started in 1960 in the lower fringe-type stands and has since moved into stands at higher elevations near and within the Bridger Wilderness. The heaviest concentration of "faders" remained between New Fork and Boulder Lakes; however, significant increases in tree killing occurred to the south. The older infestations along the Forest boundary are declining, but an increasing trend exists in and near the Wilderness. Salvage logging is recommended in areas where timber cutting is compatible with other resource uses and values.

Lodgepole stands on the Caribou National Forest have sustained a damaging epidemic since 1967. New mortality was observed throughout the Idaho Falls, Freedom, Soda Springs, and Montpelier Ranger Districts. Lodgepole stands in these areas are scattered and mixed with other trees. This condition is different from that found on the other Forests supporting large epidemics, but it has not limited the beetle population or subsequent damage. The infestation appears to have reached a peak in 1970 and should begin to decrease next year. Mortality should continue for two to three more years until the suitable host type is depleted. Control is not recommended because the bulk of mortality already has occurred and accelerated logging is not possible at this late date.

Isolated infestations continue to deplete stands in areas of the Boise, Sawtooth, Payette, and Challis National Forests in Idaho; the Cache National Forest in Idaho and Utah; and the Wasatch and Ashley National Forests in Utah. No control is planned.

Ponderosa Pine

In 1970, widely scattered killing of ponderosa pine continued in portions of Utah and Idaho. The infestation of most concern was in Bryce Canyon National Park and on the adjoining Dixie National Forest. Although the mountain pine beetle was the primary insect, a few large trees also contained broods of the western pine beetle, *Dendroctonus brevicomis* LeConte. Concentrations of dead trees occurred on Whiteman Bench and along the scenic highway through the Park. Park personnel were understandably concerned about the aesthetic impact of this damage and requested assistance from Regional entomologists. A survey conducted by Forest Service and Park personnel in 1969 showed an attack intensity of 0.5 trees per acre. Losses of this type are inevitable in mature ponderosa pine stands, such as found in the Park.

Biological data indicate that tree killing will continue in 1971 in Bryce Canyon National Park, but under

the 1970 level. On the Dixie National Forest, tree mortality will remain at about the same level.

Mountain pine beetle activity continued in the Flaming Gorge National Recreation Area and on other parts of the Ashley National Forest. Small and widely separated groups of ponderosa and lodgepole pine "faders" were found throughout the southern part of the Recreation Area. Control was not recommended in the Recreation Area because: infestations were being perpetuated in mature stands of continuing susceptibility; attacks were widely scattered over an extensive area thereby economically excluding salvage logging; and volume losses were not at an economic level. Salvage logging was recommended on the Forest.

Persistent infestations on state and private lands southeast of Cascade, Idaho, and on the Boise, Challis, Payette, Salmon, and Sawtooth National Forests continued in 1970. The outbreak near Cascade, Idaho, increased in extent, but has yet to reach National Forest lands. Other infestations on Forests in southwestern Idaho were characterized by scattered groups of from one to ten "red tops." A similar pattern of mortality should continue in these areas in 1971.

Limber pine

A large increase in limber pine mortality due to the mountain pine beetle was observed along portions of the west slope of the Teton Range, Targhee National Forest, Idaho; and on the Ashley National Forest in Utah. Apparently, an influx of beetles from nearby infestations in lodgepole pine caused this increase. Limber pine occurs on a wide variety of sites in the Intermountain Region, but it is typically found on high elevation sites around summits and on steep rocky slopes. The biology, habits, etc., of this beetle have not been studied in this host.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins

This bark beetle has caused extensive mortality to Douglas-fir in Idaho since 1966. In 1970, tree killing continued with the most severe losses occurring on the Boise, Payette, Salmon, and Sawtooth National Forests. Activity of a lesser extent occurred on the Challis and Targhee National Forests. Losses in localized areas rarely reached proportions to preclude logging operations, but the total loss on these Forests was large.

A large concentration of Douglas-fir mortality was detected on the Payette National Forest from the Secesh River confluence of the South Fork of the Salmon River downstream to the main Salmon River. As many as 500 trees were killed in some groups, but due to the logging moratorium in the South Fork of the Salmon River, salvage logging was not recommended. On the Boise and Salmon National Forest, scattered tree killing occurred throughout much of the Douglas-fir type. Losses on the Sawtooth Forest were centered mostly in the South Fork of the Boise River. Douglas-fir beetle infestations were so widespread that control by other than natural means was deemed impossible. The only alternative was salvage logging in areas with the highest concentration of dead trees. This practice did not suppress beetle populations, but enabled a resource to be utilized that otherwise would have been lost.

An administrative study, in cooperation with Boyce-Thompson Institute, was conducted on the Atlanta Ranger District, Boise National Forest, to test the attractiveness of a synthetic pheromone, frontalin, on the Douglas-fir beetle. The results of the test were encouraging: all of the 157 pheromone baited trees were attacked and only 13 of the 154 control trees were attacked. In addition, 480 trees adjacent to baited trees were attacked and only 27 attacks were recorded near control trees. It was concluded that frontalin was effective in attracting the Douglas-fir beetle to baited trees, but it was impossible to determine the effective range of pheromone attractiveness or the proportion of the beetle population trapped.

A sizeable effort is being directed toward testing bark beetle attractants, and land managers are naturally enthusiastic about the control potential of these chemicals. Nevertheless, pheromone work is still in the development stage, and there is little indication that their use, under actual field conditions, will provide an operationally effective control method in the near future.

Engelmann spruce beetle, *Dendroctonus rufipennis* (Kirby)

Overall mortality of Engelmann spruce caused by the Engelmann spruce beetle increased in 1970. The most recent and damaging infestation was detected during the aerial survey of portions of the Manti-LaSal National Forest, Utah. A followup ground evaluation confirmed aerial observations; activity of significant proportions was observed in all areas checked. Practically all affected trees were the largest in the stands, with diameters ranging from 14 to 40 inches and averaging about 24 inches. Infested trees occurred in scattered groups throughout spruce stands. Barring any catastrophic reduction in the population, an increasing trend will occur in 1971. It is possible that a large percentage of the larger trees will be killed within the next two to three years.

Most, if not all, of the infested trees on the Manti Division would have to be treated or removed to curb this infestation. Because of the scattered nature of the infestation and the potential of the beetle, overall control is not practical. The only alternative at this time is to salvage as much of the infested and dead material as possible.

The outbreak in the Hilgard Mountain Area, Fishlake National Forest, continued to decimate spruce stands. A slight increase in the incidence of "faders" was observed last summer. This area is typified by steep, rocky terrain and this situation has limited salvage operations. Approximately 400 MBF of dead, infested, or threatened timber was sold in 1969 and some of the volume has been removed. Salvage operations will continue in 1971.

Widely scattered killing of Engelmann spruce continued in the upper reaches of Dry Beaver and Horse Creeks on the Wyoming Division of the Bridger National Forest. Spruce mortality has been detected in high elevation stands since 1967. Control has not been recommended.

On the Bridger Division of the Bridger National Forest, isolated groups of fading trees have been detected over a period of years in the upper tributaries of the Green River. A large percentage of the large diameter trees were killed during a widespread infestation in the early 1960's. Since then, losses have remained at a low level, mainly due to the lack of suitable host trees. Scattered mortality should continue in 1971.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandford

Killing of ponderosa pine by a complex of this beetle and the western pine beetle continued in the Spring Mountains west of Las Vegas, Nevada. Mortality of large diameter trees was scattered throughout this portion of the Toiyabe National Forest, but losses in a summer home and high-use recreation area in Kyle Canyon produced the most concern. Measures have been undertaken since 1968 by the Forest Service, State of Nevada, and a homeowners organization to reduce losses in Kyle Canyon. Infested trees were cut, sprayed with ethylene dibromide, and removed from the area. Since these beetles tend to attack trees in groups, removal of infested groups of trees most probably reduced losses in the immediate vicinity of homesites. However, these efforts had no effect on the overall beetle trend. The Boyce-Thompson Institute and the homeowners organization tested the attractiveness of a synthetic pheromone on the roundheaded pine beetle. The results of this test are unknown.

Defoliators

Western budworm, *Choristoneura occidentalis* Freeman

This defoliator continued to infest the Douglas-fir and true fir forests in the Intermountain Region in 1970. No forest sustained serious damage, but some widely scattered top and branch mortality was observed in areas with persistent infestations. Growth loss seems to be the major type of damage from this insect, but even this loss has not seriously affected the management plans on any Forest.

Visible defoliation in 1970 was considerably below the peak level recorded in 1964. Decreasing western budworm populations and subsequent damage occurred from 1965 to 1967. A slight resurgence developed in 1968 and 1969, but a decline occurred again in 1970. The factors causing these population fluctuations are unknown. A summary of infested areas by defoliation levels since 1964 follows:

Year	Defoliation Intensity			
	Light (acres)	Moderate (acres)	Heavy (acres)	Total (acres)
1964	266,000	658,000	1,352,000	2,276,000
1965	465,600	254,500	795,200	1,515,300
1966	923,900	52,200	16,100	992,200
1967	162,200	54,900	1,600	218,700
1968	333,500	150,200	21,800	505,500
1969	338,800	125,400	30,200	544,400
1970	223,220	79,300	5,200	307,720

The infestations on the Payette National Forest, Idaho, and the Bridger National Forest, Wyoming, were the only outbreaks of sufficient magnitude to cause concern. Fortunately, both of these infestations decreased in area and intensity in 1970. Infestations on the Ashley, Boise, Caribou, Challis, Salmon, and Sawtooth National Forests also decreased. No damage was detected during aerial surveys on the Challis and Sawtooth National Forest, but very light defoliation was observed during ground surveys. No western budworm activity was detected on the Salmon National Forest. A slight increase in defoliation was recorded on the Targhee and Teton National Forests. These outbreaks adjoin the infestation on the Bridger National Forest. A listing of budworm defoliation on each Forest during 1970 follows:

Forest	Defoliation Intensity			
	Light (acres)	Moderate (acres)	Heavy (acres)	Total (acres)
Ashley	120	---	---	120
Boise	4,600	1,200	---	5,800
Bridger	46,800	9,000	---	55,800
Caribou	100	---	---	100
Challis	---	---	---	---
Payette	147,800	67,900	5,200	220,900
Salmon	---	---	---	---
Sawtooth	---	---	---	---
Targhee	11,200	1,200	---	12,400
Teton	12,600	---	---	12,600
Total	**223,220**	**79,300**	**5,200**	**307,720**

Egg mass data from the Payette and Bridger National Forests indicate that the budworm outbreaks will increase slightly over the 1970 level. No significant changes in budworm activity will occur on other Forests. No control is planned.

Leaf blotch miner, *Lithocolletis* sp., near *salicivorella* Braun

For several years, this insect has caused varying degrees of damage to Fremont cottonwood in Zion National Park. Coincident with a decline in a tent caterpillar, *Malacosma incurvum discoloratum* (Neumoegen), infestation; blotch miner damage became increasingly more evident. In 1969, premature defoliation was exceptionally heavy. The population and subsequent damage decreased in 1970. Since little was known on the biology of this pest, investigations were initiated in the spring of 1970. The findings of this study will be published in the near future.

A looper, *Lambdina punctata* (Hulst)

In 1967, scattered areas of gambel oak defoliation caused by this looper were detected along the Wasatch Front, Uinta National Forest, in northern Utah. The extent and intensity of defoliation increased in 1968 and 1969 and scattered defoliation occurred from Salt Lake City south to Levan, Utah. Since this area has a history of fire and watershed problems, the damage by this insect to the principal ground cover caused concern. Evaluations in the spring of 1970, however, revealed that a population collapse had occurred and control was not needed.

Pinyon needle scale, *Matsucoccus acalyptus* Herbert

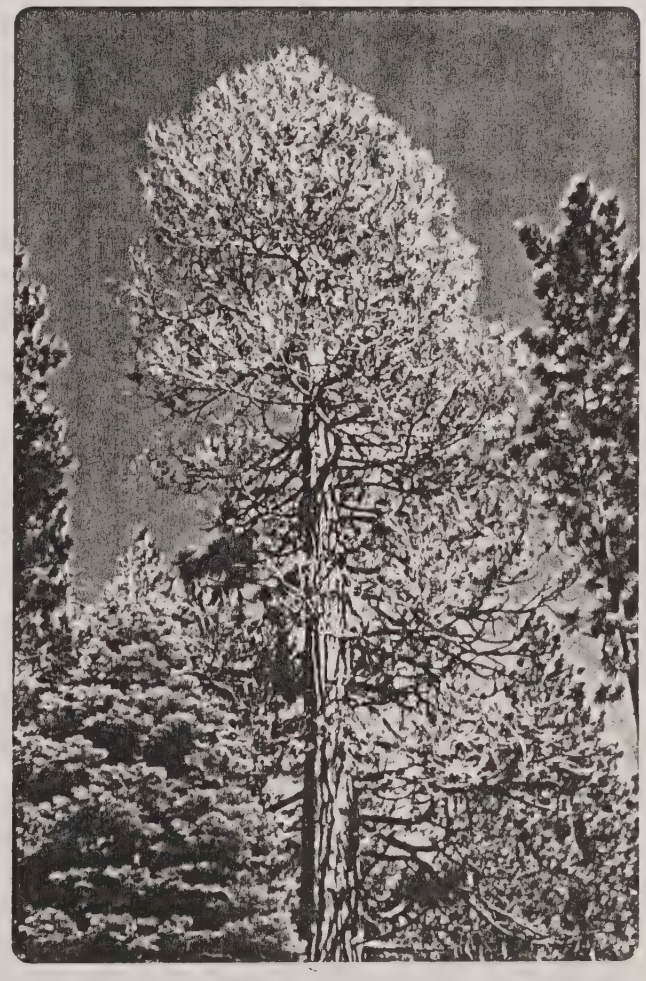
A mild winter in 1969-1970 was probably one of many factors responsible for "triggering" damaging populations of this insect on singleleaf pinyon pine in portions of the Toiyabe National Forest in California and Nevada and on the Humboldt National Forest in Nevada. In both locations, the smaller trees were the heaviest defoliated. Many trees will sustain heavy damage or possibly die before the infestation subsides. Control is not practical under forest conditions.

An incense cedar leaf miner, *Argyresthia* sp., new sp.

The apparent decline of incense cedar, visible from the highway along the southeast shore of Lake Tahoe, Nevada, was first thought to be caused by heavy roadside salt deposits. A close examination showed the affected foliage to be infested by a leaf miner. Trees of all ages and sizes were heavily defoliated and some were in a serious state of decline. A few trees may die. An effort will be made to learn something of the biology and habits of this moth as a first step in developing a practical control measure.

A sawfly, *Neodiprion fulviceps* (Cresson)

Populations of this hitherto rare defoliator reached damaging proportions in two small and widely separated ponderosa pine stands in southern Utah. One infestation was reported in pole-size trees planted as ornamentals near Panguitch, while the second outbreak was in a mature stand near the head of Clear Creek, Fishlake National Forest.



Damage to incense cedar caused by a leaf miner, Argyresthia sp., new sp.

The status of the Panguitch outbreak is unknown, but moderate to heavy defoliation is expected in the Fishlake National Forest infestation in 1971. No control is planned because there is no approved control measure.

Pine butterfly, *Neophasia menapia* (Felder and Felder)

Large flights of adults have been observed for the past two years on the Boise and Payette National Forests and visible damage on ponderosa pine may occur in 1971.

Fall webworm, *Hyphantria cunea* (Drury)

The unsightly tents and defoliation of this insect were detected for a second year on narrowleaf cottonwood and other riparian trees and shrubs in central and southern Utah.

Western tussock moth, *Orgyia vetusta gulosa* (Hy. Edwards)

A long standing infestation of this insect on a *Ceanothus* sp. continued in the Town Creek Plantation, Boise National Forest. In some areas, light defoliation of ponderosa pine reproduction occurred. The infestation appears to be spreading to the northwest. This insect was also detected on bitterbrush along the eastern slope of the Sierra Nevada mountains between Reno and Carson City, Nevada.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* (McDunnough)

Defoliation of mature Douglas-fir stands on BLM, State, and private lands in Owyhee County, Idaho, increased in 1970. Heavy defoliation was observed in several localized areas southwest of Silver City. The infestation is expected to increase in 1971. Due to a history of rapid, though unpredictable, population collapses caused by a native polyhedrosis virus in this area, no control was recommended.

Sugar pine tortrix, *Choristoneura lambertiana* (Busck)

Populations of the insect are at the lowest level in several years. The only infestation detected during the aerial survey was in Dry Creek east of Squirrel, Idaho, on the Targhee National Forest. Defoliation was light and damage to infested trees was minimal.

A leaf roller, *Archips negundanus* (Dyar)

Box elder trees were heavily defoliated by this insect for a second consecutive year in several areas in northern Utah. Data on the life history and habits of this insect have been collected and the information will be published in the near future.

A mature leaf roller larva, Archips negundanus (Dyar), feeding on a box elder leaf.

A tent caterpillar *Malacosoma incurvum discoloratum* (Neumoegen)

Populations of this tent caterpillar were at a low level on Fremont cottonwood in Zion National Park; and for the first time in six years, control was not undertaken.

White fir needle miner, *Epinotia meritana* (Heinrich)

On the Dixie National Forest in southern Utah, several small areas of light defoliation of white fir caused by this needle miner were detected in the upper tributaries of the East Fork of the Sevier River.

A white fir defoliator, *Argyrotaenia dorsalana* (Dyar)

This defoliator has been observed in southern Utah for three years, but has yet to cause significant damage to white fir.

Other Forest and Range Insects

Grass bugs, *Labops* spp. and *Irbisia* spp.

Injury to native and planted grasses by these true bugs (Hemiptera: Miridae) has occurred on ranges in Utah for many years, and damage has been sufficient in some areas on the Dixie National Forest to warrant control. Infestations were sprayed by aircraft with malathion and dibrome. Observation following treatment with malathion revealed excellent control, but those with dibrome were not as good. Reinfestation from ranges surrounding the control area occurred the year following treatment.

Little is known about these insects or the injury they cause. It appears that a black grass bug, *Labops hesperius* Uhler, has been the most important pest species in southern Utah. Measurements of *Labops* density in the East Fork of the Sevier River and nearby areas on the Dixie National Forest revealed levels of 100 bugs per square foot on plants and surrounding soil.[1] Black grass bugs were most abundant in the spring, and most of the damage to range crops was inflicted during this period. Heavy feeding on grasses caused them to become discolored and dry. The bugs appeared to be gregarious and feed on selected bunches of grass until most of the chlorophyll was removed. Heavy feeding reduced the forage value of the grass crop.

In 1970, surveys conducted by Dr. G. E. Knowlton, Utah State University, showed that the intensity and extent of the grass bug infestations in southern Utah approximated the 1969 situation; however, the damage to range crops was more severe. Heavier rainfall in 1969 enabled the grasses to recover. Control was not undertaken in 1970.

[1] Knowlton, G.E. 1966. Grass bugs: A serious range problem in 1966. Utah Acad. Sci. Arts and Letters. 43(2): 20-21.

A weevil, *Pissodes terminalis* (Hopping)

This insect damaged terminal leaders of lodgepole pine reproduction and poles in widely separated Forests in the Region. This weevil may become a serious pest to reproduction areas in the future; especially where emphasis has been placed on accelerated cutting of lodgepole pine because of the mountain pine beetle.

Pine engraver beetles, *Ips* spp.

Mortality to standing ponderosa pine trees caused by these beetles was at the lowest level in several years.

PATHOLOGY

Diseases

Root Rots

One *Fomes annosus* root rot infection center was positively identified on subalpine fir in Bryce Canyon National Park, while a second infection on subalpine fir was reported in the Great Basin Experimental Forest near Ephraim, Utah. The infection court in Bryce Canyon National Park was apparently caused during right-of-way clearing; the history of the other infection is unknown.

On the Sawtooth National Forest, Idaho, *F. annosus* centers were found in Prairie Creek on lodgepole pine, in Grouse Creek on ponderosa pine, and in Senate Creek on subalpine fir. Their histories are all unknown.

Root systems and butts of windthrown aspen in a campground on the Cache National Forest, Utah, were heavily infected with *F. applanatus.* The infection poses a threat to the remaining aspen in the campground. Replacing the dead and threatened aspen with conifer saplings was recommended to maintain cover on the site. Conifers did not appear to be affected by this fungus.

Western Gall Rust

During 1969, 500 acres were clearcut on the Boise National Forest, Idaho, to salvage mountain pine

beetle killed and threatened lodgepole pine. It was found that much of the reproduction, ranging from seedlings to saplings, was heavily infected with western gall rust, *Peridermium harknessii.* Closer examination revealed that some gall-free individuals were found in the cutover area as well as in adjacent uncut areas. Here, mature trees with dead branches but free of galls were found, while the understory reproduction was heavily infected. Apparently, some trees have a level of resistance which allowed them to reach maturity.

In 1971, an effort will be made to determine the apparent level of resistance of lodgepole pine to this rust in this and in other areas.

Other Activities and Problems

Air Pollution

Of recent concern is the potential air pollution resulting from the proposed coal-fueled Navajo Generating Station near Page, Arizona. It is estimated that by 1974, this plant will release approximately 210 tons of SO_2 into the atmosphere each day. The National Park Service, administrator of Glen Canyon National Recreation Area, and the Bureau of Land Management, which oversees nearby lands, are understandably concerned over the possible adverse effects of this toxic gas on the native vegetation In a joint meeting with Region 3 Pest Control personnel and the Park Service, it was agreed that Region 4 would serve as the liaison with the Park Service in establishing a joint regional sulfation plate and vegetation observation plot network in Glen Canyon National Recreation Area.

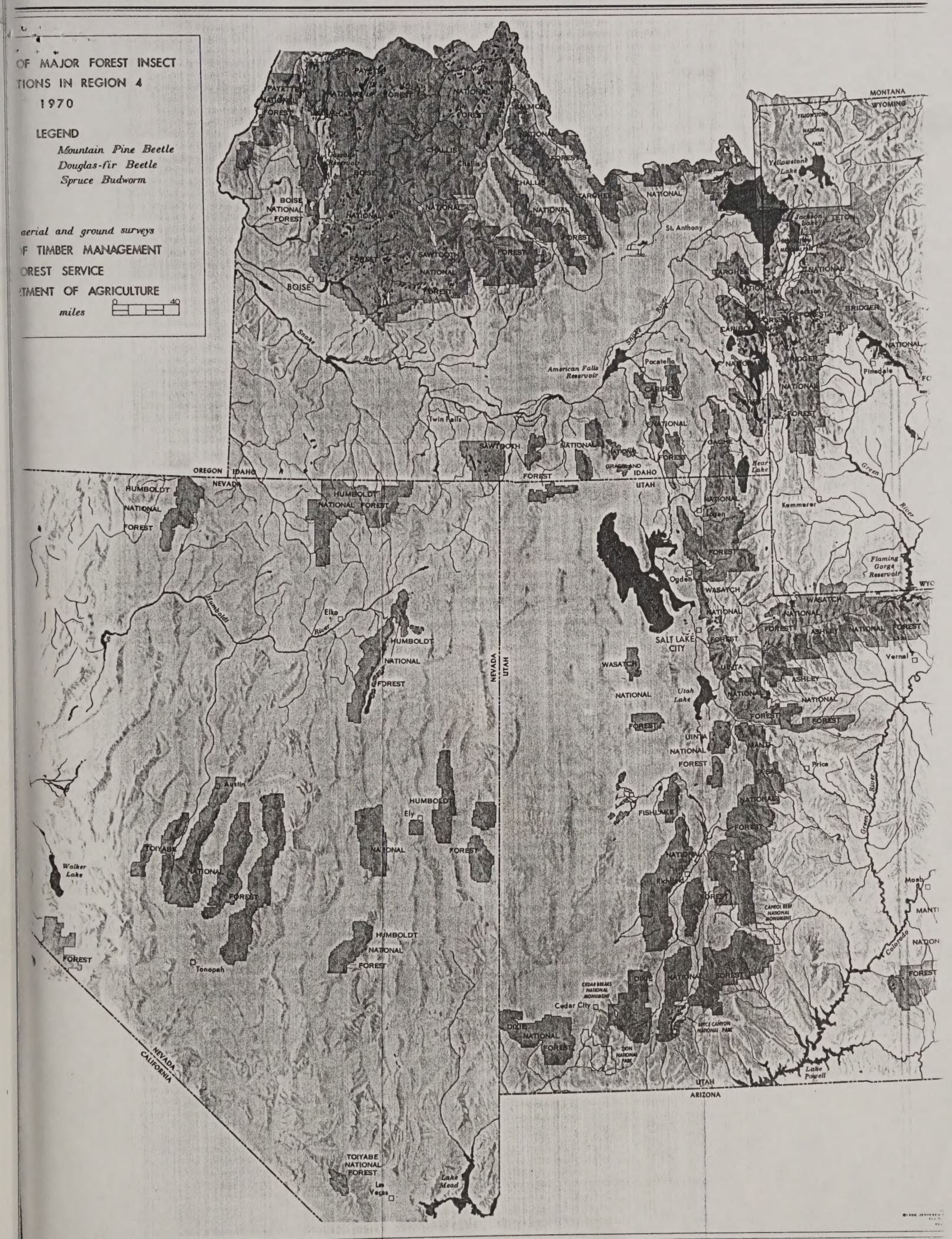
The University of Utah, in response to air pollution concerns in the Glen Canyon area, has begun a SO_2 fumigation study of both native and exotic plants.

An evaluation was made of the effects of SO_2 on vegetation surrounding the 62-year-old McGill Smelter, Kennecott Copper Corporation, McGill, Nevada. A fire had destroyed all the pinyon-juniper type near the plant. The nearest known susceptible vegetation, chokecherry and willow, was five miles away. These plants showed no adverse symptoms.

Interveinal chlorosis and some leaf margin necrosis were observed on cottonwood, Siberian elm, sycamore, and wild rose on the grounds of the Ogden Defense Depot, Utah. These symptoms could not be traced to a single pollutant. A specialist from the University of Utah examined the damage but could not identify the causal agent. It is likely that the damage resulted from an open burning trench in which only paper, carboard, and wood are burned. However, there remains the possibility that some foreign packaging materials were inadvertently burned and produced a toxic gas. This problem will be evaluated again if symptoms recur in 1971.

Land Use Studies

As part of an overall land use study, forest insect and disease evaluations were made in the White Cloud, Boulder Mountain, and Pioneer Mountain areas, Challis National Forest, Idaho. The purpose of the study was to evaluate various management alternatives to determine the best use of these areas. The multi-discipline investigations involved a qualitative ecological inventory of all resources. It will be continued in 1971.


OF MAJOR FOREST INSECT
TIONS IN REGION 4
1970
LEGEND
Mountain Pine Beetle
Douglas-fir Beetle
Spruce Budworm
aerial and ground surveys
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miles
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MONTANA
WYOMING
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IDAHO
NEVADA
UTAH
ARIZONA
CALIFORNIA
Yellowstone Lake
Jackson Lake
St. Anthony
Pocatello
American Falls Reservoir
Twin Falls
Snake River
Green River
Flaming Gorge Reservoir
Kemmerer
Ogden
SALT LAKE CITY
Utah Lake
Vernal
Price
Moab
Elko
Austin
Ely
Tonopah
Walker Lake
Cedar City
Lake Powell
Lake Mead
Las Vegas
Humboldt River
Colorado
BOISE NATIONAL FOREST
SAWTOOTH NATIONAL FOREST
CARIBOU NATIONAL FOREST
BRIDGER NATIONAL FOREST
CACHE NATIONAL FOREST
WASATCH NATIONAL FOREST
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DIXIE NATIONAL FOREST
HUMBOLDT NATIONAL FOREST
TOIYABE NATIONAL FOREST
FISHLAKE NATIONAL FOREST
CAPITOL REEF NATIONAL MONUMENT
CEDAR BREAKS NATIONAL MONUMENT
BRYCE CANYON NATIONAL PARK
ZION NATIONAL PARK
TETON NATIONAL FOREST
YELLOWSTONE NATIONAL PARK
GRASSLAND